



Ruprecht-Karls-Universität Heidelberg
Medizinische Fakultät Mannheim
Dissertations-Kurzfassung

Photobiomodulation of the response to exercise-induced damage in murine skeletal muscle

Autor: Fabiola Arpino
Institut / Klinik: Zentrum für Medizinische Forschung
Doktorvater: Prof. Dr. N. Gretz

In the last years, the photobiomodulation (PBM) has been proposed as a treatment to speed up the recovery of muscles which underwent a damaging exercise. Several studies report the effectiveness of the PBM in improving the status of injured skeletal muscles, however, little is known about the mechanisms of cellular signaling behind it. The main aim of the present work, is to evaluate the effect of the infra-/red light on exercised muscles during the inflammation, which is a crucial phase that affects the regeneration, and therefore the functional recovery of the muscles. The effect of the infra-/red light was compared to the application of another treatment, the cryotherapy, which is a common post-exercise practice. Preliminary studies on a cell line of muscular cells (C2C12) were carried on in order to confirm the main findings reported in literature and to support the following *in vivo* study. The *in vivo* study consisted in the application of the light therapy and the cryotherapy to the lower limbs of 10 weeks old CD-1 male mice, after performing a damaging exercise. Qualitative and quantitative comparisons were done on the concentration of plasma parameters and on the morphology of histological samples. A comprehensive gene expression profiling and comparison among the experimental groups was performed in order to detect marker genes involved in process of inflammation, repair and regeneration, and identify signaling pathways regulated by the different treatments.

Independently from the type of recovery (with or without therapy), the quadriceps displayed signs of damage at 48h after exercise: increase of CK levels; necrosis of fibers detected in the histology; upregulation of genes coding for costameres, membrane repair proteins, and MFRs. Instead, the gene expression of the exercised and irradiated quadriceps revealed the upregulation of pathways related to both pro-inflammation and anti-inflammation phase. Moreover, chemokines and markers for different phenotypes of macrophages and T cells were significantly upregulated only by the infra-/red light. These results suggested that the signaling cascades related to the regeneration phase had begun earlier in the PMB group.

The main finding of this project is that the immune system was stimulated by the infra-/red therapy while the cryotherapy mitigated the structural deterioration and inflammation. Which of the therapies is the best one for the recovery post-exercise, is still an open issue. It is a matter of clarifying if the light therapy speeds up the inflammatory process in advance of the regeneration or prolonging it, and if the cryotherapy protects from the damage or suppresses the inflammation delaying regeneration process.